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~~Dear Dr. Baker~~

~~Here is the summary I promised you for your Reserve Group.~~

Despite the fanfare, computer people actually have a very limited view of the revolutions their technology will bring. Not only are business and science to be overhauled in the computer revolution, but the living of our very lives. The changes in our daily lives and entire social structure will probably be more sweeping than those brought by the telephone, radio or TV.

As an example, I want to describe a basically simple computer system I have designed for the handling of manuscripts, based on my own experience and problems as a writer. When finished, this should be only the first of a family of such programs. They will permit options and flexibility never possible with systems of paper.

Then some remarks are due on the possible fate of checkbooks, letter-writing, calendars and memo pads, official forms and blanks, publishing and editorship, scholarship and the reference library, and civil liberties.

SPL : new OL

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① THE UPHEAVAL TO COME ② (brief dramatic progress)

~~③ (more on upheaval)~~ ③ SPLANDREMICS DEFINED

④ THE HISTORY AND PROGNOSIS (OF)

⑤ EQUIPMENT

⑥ CURRENT RELEVANT 'FIELDS'

⑦ 'Documentation'
⑧ 'Records Management'
⑨ Information Retrieval
⑩ Library Science
⑪ Programmed Instruction
⑫ 'Human Factors' Engineering

⑬ TYPES OF DISPLAY → see card called 'Displays'

⑭ ~~⑭~~ TYPES OF RECORDS

⑮ ~~⑮~~ TYPES OF ORGANIZATION
for presentation
for storage & transmission

⑯ WHAT WILL HAPPEN

⑰ The correct place for our Attentions
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⑱ THE REAL PROBLEMS

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There is at this moment no word for what this book is about, so the title on the cover must serve.
This book is meant to explain, instruct, predict and inspire.

The author is not an electronics engineer; he is not even a librarian, or a records consultant, or in programmed education. The author is a guesser. In this book I mean to predict some things that are going to be happening in the world. I will explain what they are, why they are important, why they will constitute, taken together, one of the greatest strides forward that mankind has ever made; and (most importantly) why they constitute one thing and will get dangerously out of hand unless treated as such.

We are on the verge of an overwhelming series of changes: changes in the way everything is done, changes in the attentions and texture of our lives.

These changes will be technological in origin, but social in consequence. They will not, in the usual sense, be "automation." That is why I have coined a new word.

SPLANDREMICS

An approach to automatic texts, display,

and information handling

The people who know the machines simply will not talk: they will not predict, they will not guess, they will not conjecture about what is coming. They have made a new kind of world ~~n~~ quite likely, and yet they will not say what it is. A few people who know the machines will predict five, even ten years into the future. Beyond that, ~~now~~ one dares stick his neck out. (But they have an inkling: it is in the air.)

~~This~~

Thus it has become necessary for the present writer, a guesser and idea man with a lifelong interest in writing, displ~~a~~, and the arrangement of presentations, to say what others will not organization and try to organize what is in the air.

SUMMARY AND NUTSHELL

I want to start out by announcing what is coming in the most striking terms possible. If that is interesting, the reader will go on to the reasons for my belief, a review of the way things have been going, how things stand today, and what the real problems of the future-- this future-- are going to be.

Let me ask that the reader suspend briefly ~~kixm~~ whatever he has been expecting and what he has been told. There is a lot of Buck Rogers talk by people talking as if they knew. I am not an expert, but I want to claim ~~x~~ emphatically that nobody is an expert, and the reader must be his own judge, in the light of the facts and arguments I present, of what may happen.

Suppose someone offered you a machine that could bring you every book that had ever been written. As you sit at this machine, the words of the book appear glowing on a screen before you. There are no pages to turn; as you ~~cove~~ coming to the end of a paragraph you touch a button, the first words disappear, and a new paragraph forms itself, instantly. If you grow tired of reading you can skim ahead to new paragraphs, or new chapters; you can summon up the table of contents at any time, or even summaries other people have written. If a particular point makes you curious-- if you do not understand a point, or believe an alleged fact-- you may press buttons that bring up further explanations and evidence. Moreover, as you proceed, the machine makes a record of what you read. If you wish to take notes on what you read, with your own summaries, underlinings, key words and so on, you may do so on a small typewriter. The words you type also appear on a screen, not on paper; if you make a typing error, you can correct it with the touch of a button, and on your command your own notes disappear. They are not really gone, however; they have been put away for you in the bowels of the machine.

This machine can hold as many words or numbers as may be stored on several bookshelves full of books. You need not <u>own</u> books any more, however, since any "books" you could want to read may more conveniently or cheaply be stored in a "library." But those libraries will be great telephone exchanges, and your book will come to you, not in a package or an envelope, but over the phone, to your machine, in a string of incomprehensible chirps.

This delivery is completed in minutes, and you are ready to read any time you like.

Not only books, of course, but every other manner of written thing comes this way. To write a letter, one types into the machine, making such corrections as are necessary, and the machine looks up your friend's address, types it, types the letter, presents it to you for signature and mailing, and stores the carbon copy.

Many letters, though, don't have to be written clear through. You can send the same letter- assuming it's news about your family, say, or a request for product information-- to any number of people, merely by telling the machine whom it is to go to: the machine will look up their addresses, type the date, and type each letter. Or you can have hundreds of stock paregraphs to assemble into letters, merely by number.

Of course, if the person you are writing to has a similar machine, you never even have to mail the letter. You just send it by telephone.

Imagine further that such a machine cost no more than a car. Or even as little as a good TV set.

The reader may feel, as I do, that such a wonderful machine would surely be worth its weight in gold: that although it presents possible drawbacks, and possible unnerving features and dangerous potentialities, that if such machines existed we would want very much to have them and to use them, and we would try to fight the drawbacks.

Then it may interest the reader to know that such machines exist. Thousands of them. At the moment they cost more than cars.

This book is about the general problems and wonderful possibil~~ities~~

ities of such machines, their design and their use.

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At some time in the near future-- between five and twenty years from now-- every process that we now associate with reading, writing and record-keeping will have changed drastically.

We will read, not from papers, books and magazines, but from glowing screens or projections on the wall. If there are actual pieces of paper from which to read, they can be thrown away as soon as we've read them-- for they can be re-created at will by the same machines that printed them. A writer need no longer handle bothersome notes and manuscripts; when he types his ideas they will go not onto paper, but into a form of storage far handier than paper: probably some form of tape recorder. When he wants to make changes in what he has written, it will be projected on a screen for him, and he can delete and insert with a pencil of light. And when he is through, he needs only to press a button and his entire manuscript will whisk over the phone lines, in minutes, to a publisher. But the publisher will not print it in a book. Rather, he will keep it on his tape recorder, and probably send it over wires to libraries and satellite libraries around the country. Anyone who wants to read it will receive it by wire on his home set.

But what kind of a book will it be? Will it be one continuous sequence of sentences and chapters, albeit appearing as a group of shadows? Probably not. It is more likely that the "book" of the future will be a collection of paragraphs or sections organized according to entirely new principles: not in one contiuous

line of words, but rather presenting its material in different order to the people reading it depending on their interests and prior knowledge.

Education will have changed drastically. Today (as yesterday) schools are places where pupils meet with an instructor in groups, then go away to do their reading. At this future time an individual will sit at a console and have written materials, texts, pictures and sounds presented to him in varying and sometimes dramatic form. Depending on his answers to questions and the preferences he indicates, a wide variety of sights and sounds will come before him. This teaching method will be so much better and faster than anything previously known that what we now call a year's schooling will be a matter of weeks. The quality of education will be vastly improved, its cost greatly reduced, and its amount -- the quantity of education people get -- increased colossally.

Our leisure-time reading will also be very different. Suppose you are interested in studying, say, Japanese history, but know nothing about it. Everything that has been written about it is available to you-- if not in seconds, in minutes. Pictures and recordings from every epoch are also within the reach of your home machine. You sit down and press appropriate controls. Projected on a screen before you is an index. You press a button selecting "History." A new index swiftly appears and you select, "Japan." It will take several seconds for the large library machine (a hundred miles away) to muster any significant amount of material, so in the meantime your machine reminds you of several things you have asked to be reminded of--

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birthdays coming up, your bank balance, the names of several new people in the office, and the exact sequence of current events in the last six months.

These images fade, and a map of Japan appears on the screen. Some background music is heard. Five hundred words of introductory text give you a rough idea of how the subject is divided for presentation. An index then appears, and you select to take a "Chronological" approach, rather than geographic, sociological, anthropological or economic. The text begins again, and with it you see photographs, and paintings, you hear music, and sometimes snaps of motion picture appear. From time to time you are asked a question about what you have just seen, and depending on how well you have grasped it, you will be presented with the same points rephrased or entirely new material.

So far all this sounds like familiar science-fiction. Presumably such equipment will be invented sometime in the indefinite future, when flights to Mars are commonplace, the problem of overpopulation is conquered, etc.

It may therefore surprise the reader to learn that all the equipment to do these things exists now.

A revolution is in progress.

The reader well may ask why, with this new revolution in progress, why nobody has heard of these things before, and why nobodoy has announced such remarkable inventions.

The answer is twofold: first, many people have heard of these things before, and, within their specialized fields, are mobilizing to cope with them in specialized ways. These different fields will be discussed below, in sections , , and .

But why have no special inventions been announced? Because there are now new inventions here; at least, none that represents since 1948 a shocking new change, like the atomic bomb or the airplane. Rather, there are just improved units of old kinds-- such as the telescope, the oscilloscope, the tape recorder-- which in their new combination make a shocking break with the old.

(since 194)
No single part/is completely new. The unity, however, is new; the types of use and the kind of planning are new.

Automatic data machines-- commonly miscalled "computers" -- are/now almost twenty years old. Their connection with other devices for display, their use in handling texts, and their use to store huge files of information, these are recent.

Here are the crucial features of this new revolution:

1. The automatic storage, transmission and display of texts by electronic and electromechanical devices.

2. The addition of "branching logic"-- alternative pathways-- to audio-visual and textual systems.

3. The reliance on signal linkage-- electrical pulses rather than mechanical connections-- between elements of storage and display systems.

It is my contention that the combination of these elements, as soon as its importance is recognized, is comparable in importance and sweep to the invention of movable type-- or, perhaps, of writing.

For every purpose that we now effect by pencil and paper -- books and tests, memoranda and letters, ideas and explanations and comments and students' notes, systems are possible using today's data equipment that will accomplish them better and faster and more clearly.

For every sort of record-keeping-- including such tabulations as cost and expense accounting, or even the details of census data-- systems are possible,using today's data equipment, that will more accurately, and more clearly, and more precisely, and far more quickly, abstract and present the significant parts that we want to know and understand.

For every kind of display function-- including graphs and charts, sounds and speech, pictures and music-- whatever might today be called "audio-visual" materials-- there are possible, using today's data equipment and accessories, systems that will make it possible for us to see much more, understand much more, and know much more.

There are a lot of words for systems of this type, one word for each specialist working on one type of such system.

But I have searched in vain for a term that covers all these systems. For I am certain that these systems have too much in common to be left to a lot of specialists; I am certain that the details and contents of these systems, though currently in the

hands of such specialists, are not by nature specialized; they ought by rights to be understood by everybody; their problems ought to be out in the open, so that arbitrary decisions made by the system designers will not be shrouded in mumbo-jumbo.

It seems to me that a new monolith has appeared in our midst, a very big and solid object, and people are tiptoing around it, and speaking in esoteric whispers, because it seems so ghostly.

I have coined the word "Splandremics" to signify all of these. Thus "Splandremics"is a united class of systems, some of which exist and the best of which do not, for

Splandremics is the unified field of record-keeping, display and automatic control; it is the union of man, his records, and his automatic devices.

A splandremic system, then is a set of equipment, procedures and units of information that will handle records, present some of them to someone, and depending on what he does, present him new things and operate other equipment. Thus Splandremics is a united class of systems, some of which exist and the best of which do not.

Automatic data equipment is extremely varied, and it lies at the heart of these matters. Most conspicuous in recent developments has been the "computer"-- a generalized, multi-purpose switching machine. Around this generalized machine have developed a host of peripheral gadgets, all of which existed in some form before the computer. Let me discuss some of these different devices. In particular I want to discuss the "computer" in a way that will dispel some of its apparent magic and make clear the reasons for its importance and versatility. Misunderstanding, buncombe and pure hogwash surround the "computer" in the mind of Americans today. Because the "computer" is "turning us all into numbers," many humanistic intellectuals are demonstrating increasing terror as the "computer" grows in importance; and what is worse, it seems likely that out of misguided fear, disgust and apathy the general intellectual is going to wholly desert those matters he should be considering about the actual functions and future use of these machines.

The very name "computer" is an unfortunate misnomer. Many other terms would be much more appropriate: "general switching machine," "automatic data processing unit," "stored-program rapid automatic device" would be some more neutral terms. But, indeed, historcally the first task of the computer was computation; and its tasks will always involve intricate, repetitious comparisons and calculations.

The digital computer in its present form was invented in the 1940's. Compared to today's earnest researches its discovery would seem almost accidental.

The first automatic digital computer was put together by an engineer and a graduate student. However, as soon as it was realized what was going on, such minds as Turing and von Neumann turned to examine its nature and its possibilities.

This first machine, ENIAC, was on completion put to use calculating ballistics.

Its advantage over a desk calculator was that it could perform a long series of operations without constant supervision and control by a human operator.

This machine performed several hundred additions per minute. (The "addition" is by now means the only thing a computer can do. However, because all the different operations generally take different lengths of time, one states the number of additions it can perform in a given machine in a second as a rough measure of its speed.)

Since then-- and it is extremely important to note this-- the machines have been getting better, cheaper and faster roughly by factors of ten. That is, a "new and better" computer is not usually twice as fast, or three times as fast, but often ten or more times as fast, or cheaper, or powerful. Several Leaps like this make up a "generation."

We are now on the fourth or fifth generation of computers-- a progress, in twenty years, comparable to aviation and rocketry in the last sixty, or medicine in the last two thousand. Where the early computers could perform a hundred additions a minute (Perhaps,) today's machines can perform half a million additions per second-- with several more leaps possible before the theoretical limits are reached. At the same time, the cost per computation has been going swiftly downward, being roughly cut in half each year.

Moreover, the number and variety of accessories which have been adapted to the computer is profuse and impressive. Originally information went in and came out as punched cards. Then they added printing machines. Then they added console typewriters. Now computers can write on the screen of a cathode ray tube (the main tube of a TV set,)

Of course they can turn anything on and off if it has a switch. And it can receive information from anything that can be rigged to affect an electrical field-- and that includes anything at all.

At this point let me attempt to explain what a computer really does, and why the name gives such a false impression.

A computer is a device which operates on information. It is not merely a control device like the thermostat (which makes a simple electrical response to a simple phenomenon, the change of temperature,) but differs radically from the thermostat in the complexity and quantity of information on which it can operate, and the complexity of its own response-- the operations it performs internally.

These operations are not a fixed list, but somewhat arbitrary. Conventionally they consist of not only arithmetic operations, but comparison operations-- "compare this number or letter with that one"-- and branching operations-- "If these numbers (or letters) are different, then begin performing such-and-such a list of operations."

In addition to these internal operations, the machine has what are called input and output operations. Without input operations it would be impossible to give instructions to the machine, let alone the news on which you want it to act, and without output operations it could not tell you its answers. Since turning things on and off constitute one kind of "answer," the machine would hardly be useful without this kind of instruction.

The internal operations of a computer are roughly like counting on your fingers-- in fact, they are exactly like counting on your fingers. But you must consider that a big machine has three or four sets of giners on which it counts, as well as over 32,000 sets of fingers in which it can set aside the results of its counting. (Or consider them to be like strips of wet clay onto which the image of the straight fingers can be pressed.)

Consider that if you had no pencil and paper, but only these

fingers to count on, you would probably invent many different and versatile forms of counting-- left to right, right to left and carry-- to do all the things you now do with paper or in your head: multiplying, dividing, etc.

Moreover, consider that you had no mouth to speak with, but could touch your fingers to another person's and transfer to his hands the words and ideas you held there for him. Then you would also develop codes that would permit the transmission of words and ideas by this method.

This is what the computer people have done. A great deal of attention has gone into tricks of finger-computation and codes by which a machine can efficiently communicate. Of course, there are no fingers in the machine, but rather the electrical equivalent: they may be thought of as patterns of sparks in the bowels of the machine which may be changed in fixed ways, which may themselves cause changes, and which may be printed or delivered to the world outside at specified times.

It may be asked, how can the computer be instructed to do so many different things? Does not the structure of the machine impose a certain fixed series of things-to-be-done upon whatever information is fed into it?

Definitely not; and this is one of the great strides that was made in the early days of the computer. The program (with its several further elaborations, the program branch, the program loop, and the program metalanguage,) create the extraordinary abilities of these machines.

A computer program is a list of instructions. Remember that the computer has wired into it certain basic instructions. None of these is carried out by the machine unless it appears on the list of instructions for a particular problem or task. This list of instructions is called a program. While it may be written as a list of code words, in fact the program is a set of exact instructions to the machine something like the following. (I am substituting the terms "left hand" and "right hand" for the real names of equivalent places in the machine.

With your left hand
~~Take a number from location one~~

(this will permit the reader to act out the program, if he wants.)
To keep the figures small, ~~let us not be~~ let us assume for the time being that we are adding two and two. "Two" is represented by holding up two fingers. "Zero," naturally, is a closed fist, and the highest we can add is five. (The other spaces can be pockets, if you like, or desk drawers, or the pages of a book.)

EMPTY YOUR LEFT HAND
PUT THE NUMBER "ZERO" IN YOUR RIGHT HAND
WITH YOUR LEFT HAND,
TAKE A NUMBER FROM SPACE NUMBER 1
ADD IT TO THE NUMBER IN YOUR RIGHT HAND

So far, of course, all we have done is taken a number from space number 1, wherever that may be, and put it in our right hand. Now continue:

WITH YOUR LEFT HAND, TAKE A NUMBER FROM SPACE NUMBER 2

ADD IT TO THE NUMBER IN YOUR RIGHT HAND

Now, after all this trouble, you have added two numbers. But of course, it is still a secret without an output instruction. So take the output instruction

HOLD UP THE RESULT FOR EVERYBODY TO SEE

and the program is completed. You have added two and two.

Of course, it is a little more general than that. The program did not say to add two and two, but rather, to add the numbers in two places called "space one" and "space two:" we have assumed that each one of them contains the number 2. But it should be obvious that the program would have added <u>any</u> two numbers, if only our hands could count above five.

All right, let's assume that. Let's assume that we have a much bigger hand; one that can count up to a hundred. (Or, as long as we're being hypothetical, make it a hundred million.) Suppose we write a program that will add up lots of numbers. Now again, take the first part of the progr

Of course it has to begin the same way:

1. EMPTY YOUR LEFT HAND
2. PUT THE NUMBER "ZERO" IN YOUR RIGHT HAND

Now we get to the adding part:

3. WITH YOUR LEFT HAND, TAKE A NUMBER FROM SPACE NUMBER 1
4. ADD IT TO THE NUMBER IN YOUR RIGHT HAND
5. WITH YOUR LEFT HAND, TAKE A NUMBER FROM SPACE NUMBER 2
6. ADD IT TO THE NUMBER IN YOUR RIGHT HAND
7. WITH YOUR LEFT HAND, TAKE A NUMBER FROM SPACE NUMBER 3
8. ADD IT TO THE NUMBER IN YOUR RIGHT HAND
9. WITH YOUR LEFT HAND, TAKE A NUMBER FROM SPACE NUMBER 4
10. ADD IT TO THE NUMBER IN YOUR RIGHT HAND
11. "
12. "

repetitious,
It certainly is isn't it. Does that mean that to add ten numbers, you have to repeat that instruction ten times in the program?

Perhaps it will have occurred to the reader that there is a delightfully simple way to save space in the program. Let us begin again:

1. EMPTY YOUR LEFT HAND
2. PUT THE NUMBER "ZERO" IN YOUR RIGHT HAND

3. WITH YOUR LEFT HAND, TAKE A NUMBER FROM SPACE 1
4. ADD IT TO THE NUMBER IN YOUR RIGHT HAND

Now comes the change:

5. ADD 1 TO THE END OF INSTRUCTION 3
6. GO BACK TO INSTRUCTION 3

If we add 1 to the end of Instruction 3, it changes Instruction 3 to:

WITH YOUR LEFT HAND, TAKE A NUMBER FROM SPACE 2

which we had to write as a separate instruction before.

The reader may grasp that with these new instructions, we have accomplished the same thing we did with a long list of instructions before. Adding 1 to instruction 3 changes "SPACE 1" to "SPACE 2", so the number from space 2 is added; and then when you go back to Instruction 3 you take the number from space 2. Then, in due course, you add it to your right hand. Then what?

Obviously, you reach Instruction 5 again, and change Instruction 3 again on that account; then instruction 6 sends you back to do instruction 3 again, and so on. loop.

This is called a program And you might make it more graphic by adding an arrow to it: (I am simplifying the wording)

Take Number 1

Add it in right hand

Add to number taken

```
1    EMPTY XXXX LEFT XXXX
2    PUT ZERO IN RIGHT
3    LOAD LEFT FROM 1
4    ADD LEFT TO RIGHT
5    ADD 1 TO INSTRUCTION # 3
6    GO BACK TO 3
```

because it loops around to repeat itself.
This short list of instructions is called a program "loop,"/

As you can see, this short list of instructions will perform the addition operation an indefinitely large number of times.
A fair machine today would be unlikely to make a mistake in millions of repetitions.

It should be obvious how versatile such a program would be for boring, repetitious calculations. For example, suppose you had thirty thousand numbers stored in space 1 to space 30000. These six instructions will add them all up without further prompting. Of course, notice that in the program loop itself there are only four instructions.

To add all thirty thousand numbers the loop is repeated thirty thousand times; since there are four instructions in this loop, the machine actually performs 120,000 instructions.

Now this seems pretty dreadful; but suppose these were real machine instructions (they are quite close to it.) Suppose we put them in a real machine. If each of these instructions in the loop, three through six, takes 1/1000 of a second, then the whole works will take 120 seconds, or two minutes.

-we are assuming a fairly slow machine-

Of course the reader will have noticed that the program as it stands would not be very useful. There is no reason to suppose the machine will sense instinctively where to stop, nor will it be at all disposed to show you what it has done, since we have neglected the output instruction.

However, where shall we put it? If we merely tack it on the end, making it instruction #7, the machine will never get to it. If we shove it in the middle, say after #5, the

tack

However, where shall we put it? We could merely tack it on the end:

```
1    EMPTY LEFT
2    PUT ZERO IN RIGHT
3    LOAD LEFT FROM 1
4    ADD LEFT TO RIGHT
5    ADD 1 TO INSTRUCTION 3
6    GO BACK TO 3
7    PRINT THE ANSWER AND STOP
```

However, it should be evident that in this case the machine will never get to the output instruction. It will merely loop forever.

In that case, we might try shoving the output instruction into the middle:

1. EMPTY LEFT
2. PUT ZERO IN RIGHT
3. LOAD LEFT FROM 1
4. ADD LEFT TO RIGHT
5. ADD 1 TO INSTRUCTION 3
6. PRINT THE ANSWER AND STOP
7. GO BACK TO 3

In this case, though, it will obviously never complete a loop. Clearly something else, some other kind of instruction, is needed.

This is the program branch. By "branch" is meant a fork, a division of the ways, where the machine could do different things, depending on the circumstances. The only way the machine can judge the circumstances is by an instruction called a test.
The most familiar machines perform tests; for instance, a Coke machine performs various tests on the money it is given.
Here is a program to make our computer act like a Coke machine:

1. REST AND WAIT
2. TEST: HAS COIN BEEN DEPOSITED? IF NO, GO BACK TO 1
3. TEST: IS IT A NICKEL? IF YES, GO TO 12
4. TEST: IS IT A DIME? IF YES, GO TO 10
5. IS IT A QUARTER? IF YES, GO TO 8
6. RETURN COIN
7. GO BACK TO 1
8. TEST: HAVE I THREE NICKELS TO RETURN? IF NO GO TO 6
9. RETURN THREE NICKELS
10. DELIVER COKE
11. RETURN TO 1
12. HAS SECOND NICKEL ARRIVED? IF YES GO TO 10
13. RETURN TO 12

As you see, by these many branchings programs can be equipped to cope with every contingency. Or almost every contingency. One disagreeable feature of the Coke machine program, above, is that by putting in only one nickel you can completely disable the machine, since it will constantly cycle between instructions 12 and 13.

Now let us try putting a test into the first program, to get us out of the addition loop.

1. EMPTY LEFT
2. PUT ZERO IN RIGHT
3. LOAD LEFT FROM 1
4. ADD LEFT TO RIGHT
5. TEST: DOES NUMBER IN INSTRUCTION 3 EQUAL 30000?
   IF YES, GO TO 8
6. ADD 1 to INSTRUCTION 3
7. GO BACK TO 3
8. PRINT THE ANSWER AND STOP.

INSERT 'BABBAGE'

The reader will see that the versatility of these machines is literally fabulous. By providing appropriate branches to the program, with instructions for special contingencies, the machine can perform interminable series of operations with infinite variations.

The reader may ask, interminable? How can it go on indefinitely without coming to the end of a task? What good would that be?

The answer is that there is a class of operations called on-line (or sometimes real-time,) in which you never turn the computer off, but hand it tasks as they come up and expect an answer back in time for it to be of use to you. For instance, in air traffic handling you may want the machine to calculate the relative speeds and positions of all aircraft in the vicinity, make sure none of them are on collision course (or near it,) and decide according to your rules which ones are to come in first. (Your rules might for instance, specify that any plane short on fuel should land first, and that the order in which planes come in should be partly based on the amount of fuel they have left and partly based on how long they have been waiting already.)

This is a called real-time application because the machine is being used to control processes taking place in real time. An answer that is too late is no answer at all. Thus the task has to be one that the machine can accomplish in the time allowed.

The term "on-line" refers to an operation that is similar but less strenuous. For instance, a secretary may want to look up the credit rating of a customer, stored in the machine. There will be no real harm done if the lookup takes a minute rather than a second.

On-line,
~~Off-line~~ then, means that you can make specific requests of the machine and get it to act right away. ~~Off-line, by contrast~~ Anything which goes into an "In" basket, however, and then gets fed into the computer, and whose results then go in the "out" basket, is not on-line. Something is on-line if it is directly linked to the operations of the computer, and not subject to any delay (other than mechanical or due to the program.)

THE PAST, PRESENT AND FUTURE OF AUDIO-VISUAL

A field with many devotees today in education/group is a ~~xxxxxx~~/of techniques called "Audio-Visual Methods." In the larger sense of course, audio-visual methods have always been with us; and in the still larger sense which I am about to elucidate, they will take on an entire new scope,/sense ~~xxdx~~meaning~~x~~ and universality.

The audio-visual "movement," of co rse, is quite limited in its outlook and intent. So I mean to go back further, in order to look at these matters from a still more general point of view. Sights and so nds have been always with us; indeed, speech and pictures have been with us since we became human. And from that time speech and pictures have gone together to make things clear. Even drama and ritual may be considered "audio-visual", in a certain special sense.

But it remained for invention to make possible ~~xxx~~ the union of sight and sound on any other basis than the difficult and inefficient drawihg of pictures to accompany human speech. The invention of photography in the nineteenth century, and the concommitant improvement of the lantern slide made possible a vastly improved presentation to audiences of graphic material. ~~Xxxxx

detail beforehand.

This development represents an important and distinguishable departure from anything before. It establishes an automatic linkage between the picture and the sound.

The numerous developments since that time have been--except for the very recent ones-- well known. They consist of three major trends: the improvement of the technology of photography and of its presentation; the improvement in the arts and techniques of audio, as well as considerably increasesd flexibiliyy in its use from practice; and a vastly improved technique in the running audio-visual presentation--by which I mean both films and television. Let us examine each of these in turn.

Photography began a t the outset with huge, unwieldy ca cameras and "film" of heavy, fragile glass plates which had to be developed on the spot. The first "prints" were tintypes, and had to be held at certain angles with respect to the light to be properly viewed. Since that day, of course, the main trehd has been toward smaller cameras, better films, lower cost and more simplicity. The historical highlighys were the first "Kodak" camerak in 19-- (which had to be sent back to the factoty for relaadimg) the roll-film cameras which became popular in the 1920's, and fonally the miniature cameras. The mast significant date for miniatire cameras was 1922 (?) when a renowned German optical firm introduced the Leica--a camera designed to use motion picture film, 35 mm wide. This 35mm camera revolutionized the techniques of photogtaphy by its smallness and the low cost of its film.

It brought with it the disseminati n of photographic skills among the public. It made easier the development of an entire school of photography, "photo-journalism" much of whose development took place under the auspices of LIFE Magazine. In a parallel development 35mm film and the mass production techniqued associated with the motion picture film brought about the development of the Filmstrip, a sequence of photographs prepared for serial viewing or projection.

Techniques of projected pictured began, of course, with the development of the lens on the 17th (?) century, but until the development of photography there could obviously be no way of making copies of things to be projected-- except throug printing, of cutouts or similarly unsuitable methods. Moreover, without practioable lamps of cooling fans, boyh requiring that electricity be tamed, projection could never be made useful.

Photography and the light bulb, then, brought the Magic Lantern. And so it was possiboe for photographic displays, for example illustrated lestures of the Holy Land to be seen by wide audiences.

As photaography progressed, and became a household matter, projictors became household appliances. The most dramatic advance eccurred after the introduction of Kodachreme in the 1930's, when the projector became a necessary complement to the camera. With the introductioh of the magazine-load projector in the early 1950's, and the remote-control slide chahger shortly thereafter, the ease of presenting lon g sequences of illustrative materials without fuss ahd at low cast reached a new extreme.

This last represented an important step. If you can change a slide with an electrical pulse, it is not necessary that someone press a button for the electrical pulse to occur. Other events can trigger it. Thus of course it is no surprise that systems were designed which would arrange for triggering impulses from other sources: particularly sound sources. Systems are now commonly available for linking slide projectors and tape recorders. This is done either by prerecording particular signals on the tape which then cause the slide to change; or by gluing silvered markers on the tape; or by even making pencil marks on the tape, in one system. In all cases the effecg is the same. The two devices have been linked together not mechanically, but by signals-- and what can be done by signals can be done with more flexibility and ease.

It is to Thomas Edison that we owe the technology of sound recording; although as with so many other inventions mentioned here, it would surely have been invented eventually out of its own "internal necessity." However, as it happened to come about in its original form, it was done by varying the depth of a groove in a rotating drum made out of shellac. In later application this gave way to the less elegant but more convenient rotating disk. Later, in conjunction with films, a recording system using a transparent stripe of varying width became practical.

During the war, a wholly different recordig technique was invented, which imparted magnetic images to a passing wire or tape coated with a suitable magnetic compound.

These a e the basic forms: the cylinder, the disk and the ribbon; the groove, the path of varying light, the

magnetic surface. H owever, they have now been recombined in so many different systems as to be not worth detailing. For only a few examples, the cylinder (now flexible and called a "belt") has recordings made on it with grooves in the dictaphone and magnetically on IBM's dictation machine.

The technique of films expanded its flexibilityes rapidly since its invention also by Edison in 18--. Under D.W. Griffith, it expanded from merely the static depicti n of events hy an unchangihg, an moming camera to a varied pace and varied camera angle and motion. Whensound was added to the motion picture, this history of expanded flexibiliyy and was repeated. At first the sound and picture had to be made at the same time. Then it was discovered that if the optical sound was recorded in a separate camera, unwanted sounds could be removed, and others inserted, improved, and augmented-- as in adding echoes to the sound in rerecording. By the time of Orson Welles' film "Citizen Kane" in 1940 (?), it was relatively easy for Welles to produce such effects as the sound of a womanIs scream becoming the sound of an automobile horn of the same loudness and pitsh. as one scene gives way to another. Gradually the editing of soung became a fully mature and integrated part of the picture. (A stunning example of this mature phase was the 1952 (?) picture, "King Solomon's Mines." An important technological onnovation in the 1950's from our point of view was the transition from the use of sound recorded optically to sound recorded magnetically. However, this could not be accomplished merely by running cables of connecting rods from the camera to the recording machine. Since the attempt was to use tape without sprocket holes, (insert in above sentence)

This was accomplished by the Rangertone system, whereby a signal generated on the camera is recorded on the tape along with the sound. When this sound is later transferred to optical recording, the Rangertone signal assures that its length on the final strip of film will correspond in every timing respect with the action in the picture.

I wish to emphasize that this, too is a signal linkage -- which anticipates so many versatile possibilities.

(Two other things I want to mention in regard to films, but I'm not sure how, are sequences of explained stills, as in the "Titan" and the documentary newsreel film. As a matter of fact gotta also mention instructional films.)

((Put the TYPES OF MOVIES into some section on developments and traditions?))

Interview

WHAT LIFE WILL BE LIKE WHEN THE MACHINES TAKE OVER

Interview With Dr. Simon Ramo, Electronics and Space-Age Scientist

Reprinted from "U.S.News & World Report"

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WHAT LIFE WILL BE LIKE WHEN THE MACHINES TAKE OVER

Interview With Dr. Simon Ramo, Electronics and Space-Age Scientist

As the U. S. moves further into the electronic age—

What changes are coming in the way people live? Will computers run offices and factories, cut off jobs, shorten working hours?

What will electronics do to medicine, banking, schools, politics, home life?

From a man with broad background in science comes a revealing glimpse of what the push-button era will be like.

Dr. Simon Ramo is an authority on automation and electronics. He came to the conference room of "U. S. News & World Report" for the exclusive interview that follows.

Q Dr. Ramo, is the age of computers to bring big changes in the way we live in this country?

A Yes. The second half of this century—the decades just ahead—will be the period in which we're going to make the transition to a highly automated, electronic society.

Q Will that be a real scientific revolution?

A I think it makes more sense to talk of "evolution" rather than "revolution." If you list all the things that are likely to happen—things that technology makes possible—you find they are so complex and expensive, and require the training of so many people, that it's just bound to take time for these changes to occur.

Q And a lot of money, too?

A The cost will be not merely in the billions of dollars, but in trillions. We've got to update the entire physical plant of the United States.

Q In what way will this updating occur?

A We're working toward a combination of men and electronic machines to do the best possible job in every type of human activity—in transportation, communications, medicine, law, education, government. It's a combination I call "intellectronics."

Q That's a new word. How do you define it?

A Well, I felt we needed a better word than "automation" to describe this new partnership between men and machines.

To most people, automation means merely substituting a machine for a man's hands in a factory. The bigger issue is the partnership of men's minds and machines—"intellectronics"—which is a way of extending man's intellect by the use of electronic devices and electronic networks.

Q Is it an added dimension to people's brains?

A Yes. In everything we do—whether in the professions, in controlling factory production, in the military, in teaching—when we break down what we do with our minds, we find a part that's best assigned to electronic machines.

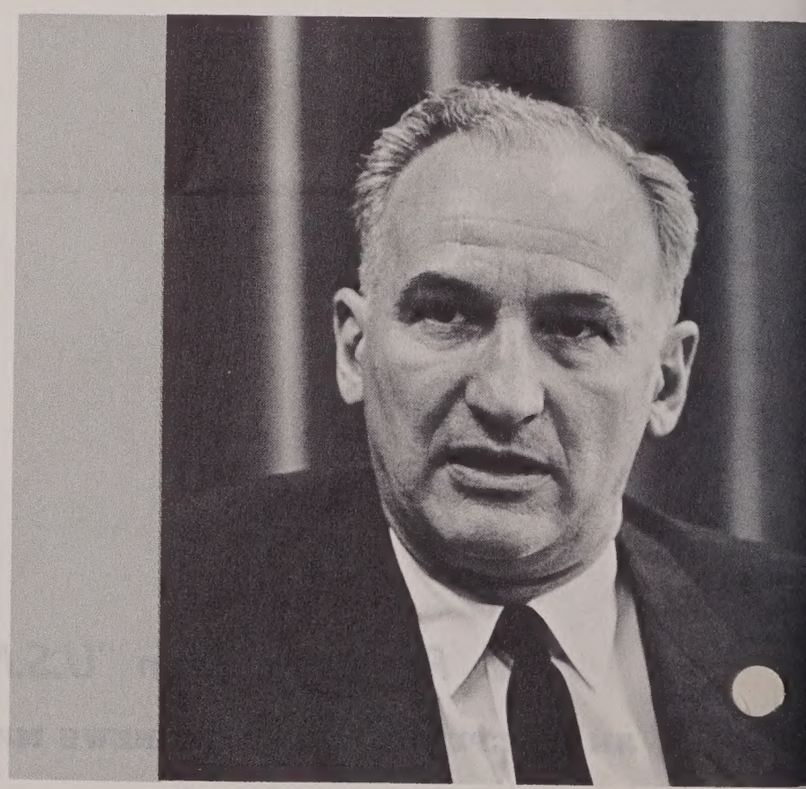
These machines can remember facts, store up rules, apply "logic," arrive at new conclusions, pass on this information to us or to others. It gives us a new way to run a business or a school, or to practice a profession.

Q How do you think the new role for electronic machines will work out?

A It's an added or different role for both man and machine. We'll have a series of nationwide electronic networks for storing information on all sorts of subjects. Computers will scan these mammoth libraries. They'll sort, select or reject information and come up with split-second answers.

Q Can you give an example?

A Suppose a man comes to his doctor for an examination: The results of the physician's tests, observations, the background on the patient's complaints and symptoms, and perhaps even the doctor's proposed treatment, will be fed into a convenient console in the doctor's office. Quickly, all this goes into the national network of medical information. It's processed instantaneously against the medical records and statistics stored there.



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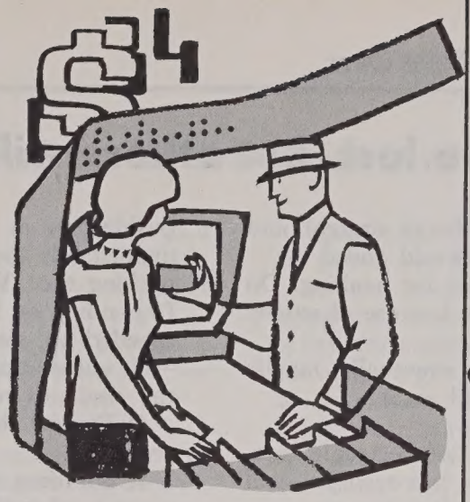
In the future, when physicians examine patients, "results will be fed into an [electronic] console. Back may come general approval of diagnosis—or some suggestions."



To buy on credit, "everyone may have some simple form of identification — maybe a charge plate held in front of a little scanning device," part of a national network.

With "intellectronics," a manufacturer could gauge demand by the public quickly. "The whole system of production ought to work more smoothly and ought to be cheaper."

Back may come a general approval of the doctor's diagnosis. In effect, the machine says to the doctor, "You seem to have all the pertinent facts on this case, and you seem to have selected the treatment most likely to succeed."

Or, the machine may come back with some suggestions the doctor hadn't thought of. He may decide to make further tests.

Q Does that mean every doctor will have to be an electronics expert to work the machine?

A No, the doctor probably won't go to the machine himself. He'll have assistants who may not understand much about medicine, but are experts at operating the machine, just the way a good secretary operates a typewriter. There will have to be other people, "medical engineers"—members of a profession that doesn't even exist today. They'll lay out the system, keep the information up to date, figure out how to correlate and process the facts. This will call for people of high intellectual ability, perhaps people with both engineering and M.D. degrees.

Q Does all this mean that tomorrow's doctor won't need to read medical journals, or study to keep up to date?

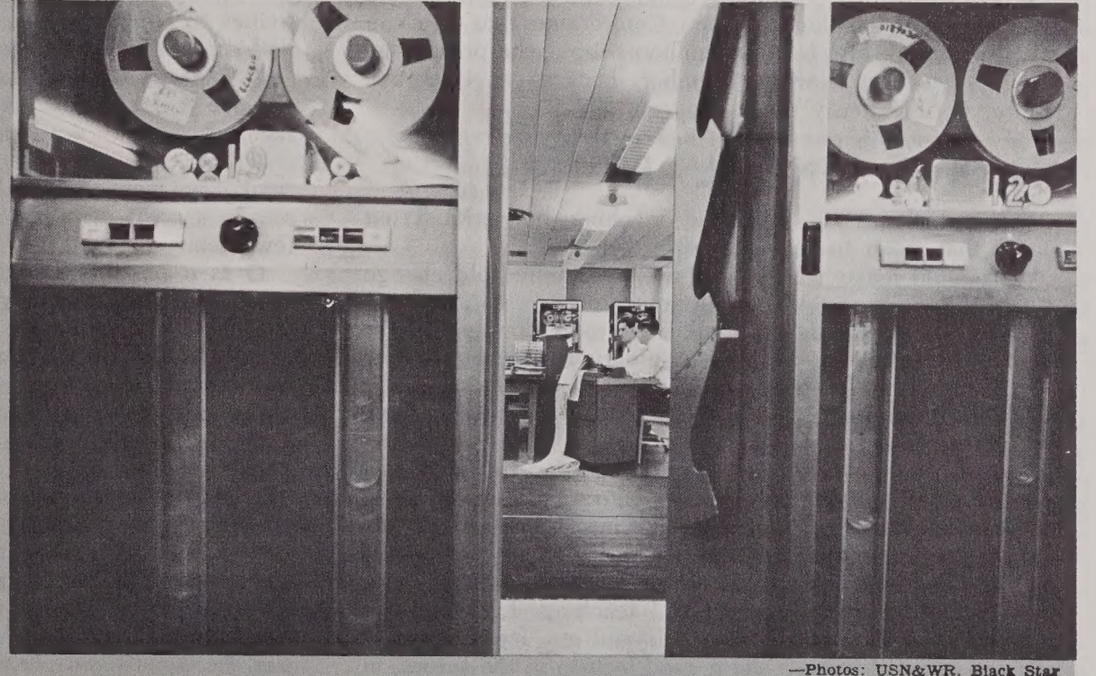
A No, you can't say that. The practice of medicine will take on new dimensions. The doctor will have an even tougher time than today to keep up. He'll need every conceivable aid, including medical journals, because the practice of medicine will be changing rapidly. Truths that simply are not available to doctors now will be brought out when computers are used to analyze the relationship between cause and cure, the efficacy of drugs, the whole pattern of man's health.

Q What about other professions?

A The same principle of electronic network communication will be applied to law, politics, banking.

Take the practice of law in the technological world of the future. Every practicing attorney would have in his office means for convenient electronic connection to a huge national file of legal facts, rules and procedures. For the routine filing of papers, records and petitions, an assistant would put data into the electronic system. Any conflict, omission or inconsistency, or any problem with the law or with existing records or claims would instantly be flashed back to him. Without such advances we are threatened with a chaos of

Dr. Simon Ramo, 50, has a national reputation as a scientist, engineer, educator and industrial executive. An expert on automation and computers, he is vice chairman of the board of Thompson Ramo Wooldridge, Inc., West Coast producer of electronic, space and missile components. Dr. Ramo holds a Ph.D. degree from California Institute of Technology, and is a lecturer there. He is the author of books on electronic theory, and is a consultant to several U. S. Government scientific groups.



—Photos: USN&WR, Black Star

The age of computers: Ahead lies "a highly automated, electronic society"

. . . "Some jobs will be lost, but others will be created"

mounting red tape, as we try to keep things straight and orderly in the increasingly fast and busy world ahead.

Q You mentioned an electronic network for banking. Do you see the time coming when we'll make less use of money—currency and coins—than we do now?

A Yes, I think coins and currency, and, eventually, maybe even checks, will be mainly for the rural areas.

Q You do? Why so?

A When we get down to using these "intellectronic" networks, we may find that not only industry, but even personal accounting—our bank account—is best handled by use of an electronic system. It will be the cheapest way to do it. The Government will be anxious to have this happen, because the tax people are always looking for ways to collect taxes before you get any actual cash in your hands. Merchants and salespeople, too, will be happy to keep their credit records right up to date. It will save them trouble, help their planning.

Q But how could a system of that kind work?

A In the future, everyone may have some simple form of identification—maybe a charge plate, maybe your thumbprint held in front of a little scanning device. If you buy a necktie or a house, your thumb before the scanner will identify you. The network will debit your account and credit the seller's account. All of this will be done over some national credit network whose headquarters may be far away in another city.

Q But won't this lead to some colossal mistakes?

A Well, in a poorly designed system, maybe when a transistor burns out, you'll lose some money that should have been credited to you. But you can also see ways in which such mistakes can be prevented.

Q They can't prevent them now. Doesn't the Government, every once in a while, issue a million-dollar check to a person instead of a $1 check?

A Let's say there's a little de-bugging yet to be done. Of course, we've got to make sure the apparatus is reliable. You'd want to be certain that your fortune wouldn't be wiped out through some electronic mistake. You might have parallel networks just to safeguard against that sort of error.

Q How reliable are these electronic devices?

A The chances of something conking out are getting more rare. Take the telephone system: Considering that you can call any one out of a hundred million people, the percentage of times you get a wrong number, because of electronic failure, is ridiculously small.

MAKING SCHOOLS BETTER—

Q How about an electronic teaching network? What would that mean to our schools?

A It could make a tenfold or even a hundredfold change in their effectiveness. We are approaching a crisis in education. The needs of a more complicated, more populous world are increasing rapidly, while our ability to put human resources into the teaching profession is decreasing.

Q Don't we have "teaching machines" already coming into use in some schools?

A Up to now, we've made very little use of technology in our schools. Why shouldn't the routine materials of learning be given students by machines, leaving the more difficult tasks for the human teacher?

Q How would automated teaching work?

A Let's not call it "automated" teaching. Let's say the teachers have an array of new aids and an "intellectronics" network to assist them. Take a good lecture in the future, in the form of a film, except that each student would have a pushbutton at his desk. He registers whether or not he understands the material that's being presented to him, by pushing the "Yes" or "No" button in answer to questions. Depending on how well he understands, the system can be speeded up, slowed down, altered to give more information—all automatically, as a result of continually monitoring the student's responses to questions.

Q Doesn't this become an awfully nonhuman, mechanical process?

A No more than a book assignment is. The system can be a great aid to the human teacher. A network of facts on the students can immediately recognize an individual student, give him an accelerated or special test, show where he ranks in relation to others—all by an instantaneous scanning of his record. When a teacher calls in a student for special attention, she'll have before her his whole academic record, along with suggestions, notations, as to what the statistics indicate he needs next or is best suited for.

The teacher is aided by this massive electronic memory, by the marshaling of facts that she wouldn't have had time to collect by herself, just by dialing the student's number. What we would expect of the teacher is a better job. From the whole system, we'd expect a better job of education.

WORK FOR THE UNSKILLED—

Q Is there going to be any place in the electronic age for an unskilled person?

A A large number of unskilled workers will be needed to help build and maintain the electronic networks, and to do what I call "light-bulb changing" types of jobs. We'll build electronic circuits so that when one part wears out, you just unplug that whole part and replace it with another one. There'll be a little red light that will signal when a circuit burns out, or needs attention.

Q So, instead of destroying jobs, will this electronic system create some new ones?

A Some jobs will be lost, but others will be created. This isn't something you can prove, but it's a fundamental thing I keep noticing: Whenever you create new intellectual pursuits, things useful to man, you need a whole set of new activities to support them, right down to the man who does nothing but deliver a new piece of equipment.

Q We've heard a lot about the push-button factory. Do you see the time when a handful of men will operate a big factory?

A Yes, that is entirely possible. It has begun to happen. I think if we were to come back a few decades from now, we'd see, in a great many factories, lots of machines and only a few men.

Q Is it possible to design an auto assembly line, for instance, that will need only a few supervisors to assemble cars?

A If you're asking me for a guess, I'd say that probably even in the year 2000 it will turn out to be less economical, less sensible, to go that far than to have men at work assembling cars.

Q So, for some jobs, are men more efficient than machines?

A Well, man himself is a rather complex machine. Suppose you say, "I want to take certain raw materials and change their form until out comes an automobile, and I want to do this as cheaply as possible." Then you have to notice that man has in his head over a billion transistors, visual and audio senses, and is equipped with flexible motion capabilities. He is not too expensive.

You might expect to find it less expensive, in the foresee-

. . . Electronics in business: "more information to work with"

able future, to use men for many, many tasks rather than build costly and complex machinery to do the same job.

Q But we do have many fully automatic plants now, don't we?

A Yes, we have computers running some big plants—oil refineries and chemical plants, for example. I think we'll see a lot more of that.

Q How do these automatic plants work?

A They have what we call "on line" control. They have devices for measuring what is happening second by second. That information goes to a computer that figures out if any changes are needed, or any corrections. If so, other devices go into operation to make instantaneous changes. The computer, you see, is "on the line" itself. There are even simpler examples of on-line control.

Q For instance—

A Well, take the thermostat on your home heating system. That is a sort of crude on-line device. It measures the room temperature from moment to moment. If the room is too cold, it turns up the heat; if it's too hot, it turns the heat off.

Another example is the device for tuning your TV set to get the most satisfactory picture. You keep adjusting it while the set is working, until you get the sharpest possible picture. That's on-line control.

Q How would this sort of up-to-the-second control system be used in business offices? How would an executive's job be affected?

A Today, the information a man gets to help run his business is largely an after-the-fact type of information. It tells what has happened in the past. It's well described by the word "accounting." We account for what has happened. The businessman looks at the accountant's figures to see whether or not he made money last month, or last week. As a result, he may decide to change some things. But by the time he gets them changed, they affect next week's or next month's operations, not today's. Electronic systems will change all that.

Q How?

A Well, ultimately, the businessman can have access to information so fast that it can be put to work immediately to influence decisions that would otherwise have to be made more slowly by humans acting alone.

For example, data on incoming orders could be used automatically to schedule the flow of raw materials into a plant. Perhaps the raw-material supplier himself would be part of the system. So would your bank, because it pays the raw-material supplier. And so would the Government, which might take a cut in the form of excise taxes or income taxes. What you begin to see is a whole national accounting network, all tied together, and all "on line."

LESS NEED FOR "HUNCHES"—

Q Would management's responsibilities be affected by all this?

A Managers of large businesses, in the future, will be less involved in the day-to-day activity of guessing what to do about situations that are turning up. They'll have an up-to-the-minute picture of all facets of their business. They won't have to make forecasts on the basis of hunches, of guesses—they'll have much more information to work with.

So business managers, instead of sitting around considering what to do on the basis of inadequate data—often having to take sheer gambles—can devote more attention to the nonroutine. I think we'll expect better performance from the operators of our businesses.

Q In what fields are these new control systems likely to be put to use first?

A In a sense they're already in use by the military—for tying our armed forces together all around the world. In a day when action by a potential enemy can result in oblivion for another group halfway around the world in the space of a few minutes, it's necessary to keep track of a great many things on a minute-to-minute basis, and make that information available to many people. Our strategic planners already are doing that, using some very advanced types of electronic equipment.

COMPUTERS ON THE JOB—

Q How about industry—

A In some industries this sort of minute-by-minute control is beginning to happen. You find it in transportation, for instance—the way you can get instant confirmation of an airline reservation through a nationwide network. And you find it in air-traffic control. Again, in industry we're beginning to move rapidly in "process control"—that is, using computers to control processes or machines that are fabricating things. The next step is to try to control the information that schedules the over-all business.

What today's businessman is coming to realize is there are too many things to keep track of, too rapidly changing a business picture, too much processing of facts and possibilities to leave all the work to humans. Since much of the intellectual process is clear—it just involves high quantities and rates—the machine partner, properly tied into a business, relieves the burden on human minds, and makes for more efficiency, higher profits, greater security. The final step is to tie the public in on these "intellectronic" systems.

Q In what way?

A Suppose, for example, we had a quick method of letting everyone express not just an interest in the sort of automobile he'd like to have for 1964, but, for a discount, commit himself ahead of time. It might bring down the price of cars.

The manufacturer could commit himself for materials well ahead of time, he could schedule production on a stable, uniform basis. He'd know how many cars of a certain color he could sell, how many with automatic transmissions. The whole system of production ought to work more smoothly, and it ought to be cheaper.

Q As we get more and more automatic controls in business and industry, will more and more people be thrown out of work?

A People's jobs will change. Mainly, there'll be new lines of work that will use more people than today, because output can be better scheduled, and marketing decisions made more skillfully—thus more new products, more use of all our resources. But, of course, there will be dislocations as certain operations are changed.

Q Will these be temporary dislocations?

A That is my optimistic prediction. Over the long run, our "intellectronics" dominated economy should be able to create more jobs than we can fill. But I'm not sure we'll plan ahead well enough to minimize those dislocations during transition from here to there. I can foresee an enormous problem, and I don't underestimate it at all.

Q Then do you see a time of shorter and shorter workweeks, to spread the work?

A I don't see any basic reason why the technological society we're headed toward needs to be one with a radically shorter workweek. But when people are thrown out of work,

. . . "You may turn on a 'voting machine' in your living room"

there are bound to be emotional reactions. We may find ourselves legislating shorter workweeks.

Q Will that be bad?

A I don't think our society would necessarily fall apart. I can imagine a stable society with people working, say, 30 hours a week—five days of six hours each.

Q Does all this suggest a bigger role for Government in our future?

A We need aggressive Government planning and understanding, to cushion the dislocations that will occur as we shift over to an "intellectronics" society.

Beyond that, as we set up these tremendous information-storing and processing networks, the Government is going to have to set standards. Some will be mundane engineering standards. Others will be more complex legal standards. After all, we're going to set up huge libraries of information. Who owns them? Who has access to them? There will have to be standards in the use of language, in the way information is expressed, in the devices that store information.

Q Does this suggest possibilities for greater government control over people's lives?

A I do see possibilities for it. Actually, I think there are two directions that are conceivable. One is toward complete and absolute government control.

On the other hand, there's an entirely new factor that comes in. That is the possibility of such improved communication among people, such easy access to information about what's going on, that we may have a new dimension in democracy. We may have true democracy in the old sense of letting the majority of the people decide what they want.

Q What do you have in mind?

A Well, just take an example of what is possible if we want it: In the year 2000 you may come home and turn on a "voting machine" in your living room—a machine that's part of a national hookup—and you'll get a television review of the political issues that have come up that day. You'll hear arguments on both sides. You'll get a chance to vote for one side or the other. You'll push a button on your machine, and your vote, and all the millions of others in the U. S., will be registered simultaneously. We'll know how the people really feel. The public will be better educated about national issues, more alert, more interested.

Q Are you going to throw Congress out of a job?

A No, not really. Congress will change its form, or approach, is all. It will become a body to articulate issues, stay out in front, provide leadership, decide what to do with the poll results. The whole thing could be far more efficient than our present method of communication between citizens and their legislators.

AID TO MARKET RESEARCH—

Q So we'd have a sort of "on line" democracy?

A Yes, that's it. And while we're at it, we might as well consider using our voting machines for commercial purposes, too.

Q In what way?

A You could have "commercials" from manufacturers that would be a form of market research. A manufacturer might say, over the voting network, "I'm planning next year to produce a certain product, provided you like it. Would you buy one at $100? Would you still buy it at $200, the price if the quantity is low? Will you commit right now?" Everyone who was interested would vote right on the spot. The manufacturer would have a pretty good idea of how to plan his production.

Q What other typical things might happen to a family in this coming electronic age? How will a man get to work?

A He may have an automatic automobile. To move about in cities, he may have a car that operates under his control on the side streets, but when it hits the main boulevards—say they're about a mile apart—he moves up onto an on-ramp and his car is taken out of his control. When he reaches the exit he wants, he pushes a button and his car is taken back off the freeway.

Q Will the housewife do her shopping by pushing buttons at home?

A Of course, she can shop today by using the telephone and having groceries delivered. Tomorrow, she might have a particular store's wares displayed for her on a television-like screen, if she dials the right request in her shopping box. She may want to cut down the time she spends on routine shopping, to devote it to other things—staying up to date on national issues, for example.

COMING: WORLD LANGUAGE—

Q What other changes do you see ahead?

A Well, eventually I think there will be world agreement on a common language—a machine-influenced language—that everyone, everywhere will be able to understand.

Q Will it be English, or Russian, or something else?

A Probably it won't be any of those. It will be an informational type of language. Children will pick it up and talk in it. A truly cultured man, in the future, will be one who is skilled both in the machine language, and in his natural language. We've had attempts to work out an international language in the past, but the important pressure really wasn't there—no economic incentive.

Q What sort of language will this machine language be?

A The machine in an "intellectronics" system won't like fancy language. It will want a set of crisp, short sentences that convey information. The machine doesn't care about beauty in language. It's got to be simple, consistent, logical, direct—no double meanings and arbitrary grammar.

Q What about today's computers that can translate languages?

A Before long, it will be nonsense for a Russian, say, to talk to an American through an automatic language translator. We're doing that today. At our company, we're translating Russian automatically into English and doing a pretty good job of it. But, in the future, both we and the Russians will communicate in a common language that our machines will understand.

Q Are all these changes that you see ahead going to benefit us, as individuals and as a country?

A I think the world of the future offers all sorts of rewarding possibilities. We'll have many more tools with which to work, many new professions and jobs, many new products to enjoy. But we have to grow socially to realize the benefits of advancing technology. It's something like the biologist who is suddenly given a microscope that didn't exist up to now. He can see things he could never see before. Two things happen: First, he knows less about biology than he did before, because he is aware of more mysteries than he thought existed. And suddenly he is eager to standardize the microscope so that it can be made available to every biologist. He knows then that biology will advance by leaps and bounds.

So if we can get the new "intellectronics" network to take over a good share of the burden of routine tasks—the handling of information, the physical operation of the world—man may then have a chance to put his brains to work on the necessary original and creative thinking to figure out the goals we really want, to make social advances that have been lagging behind our technological advances. **[END]**

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THE NEWS OF NATIONAL and INTERNATIONAL AFFAIRS

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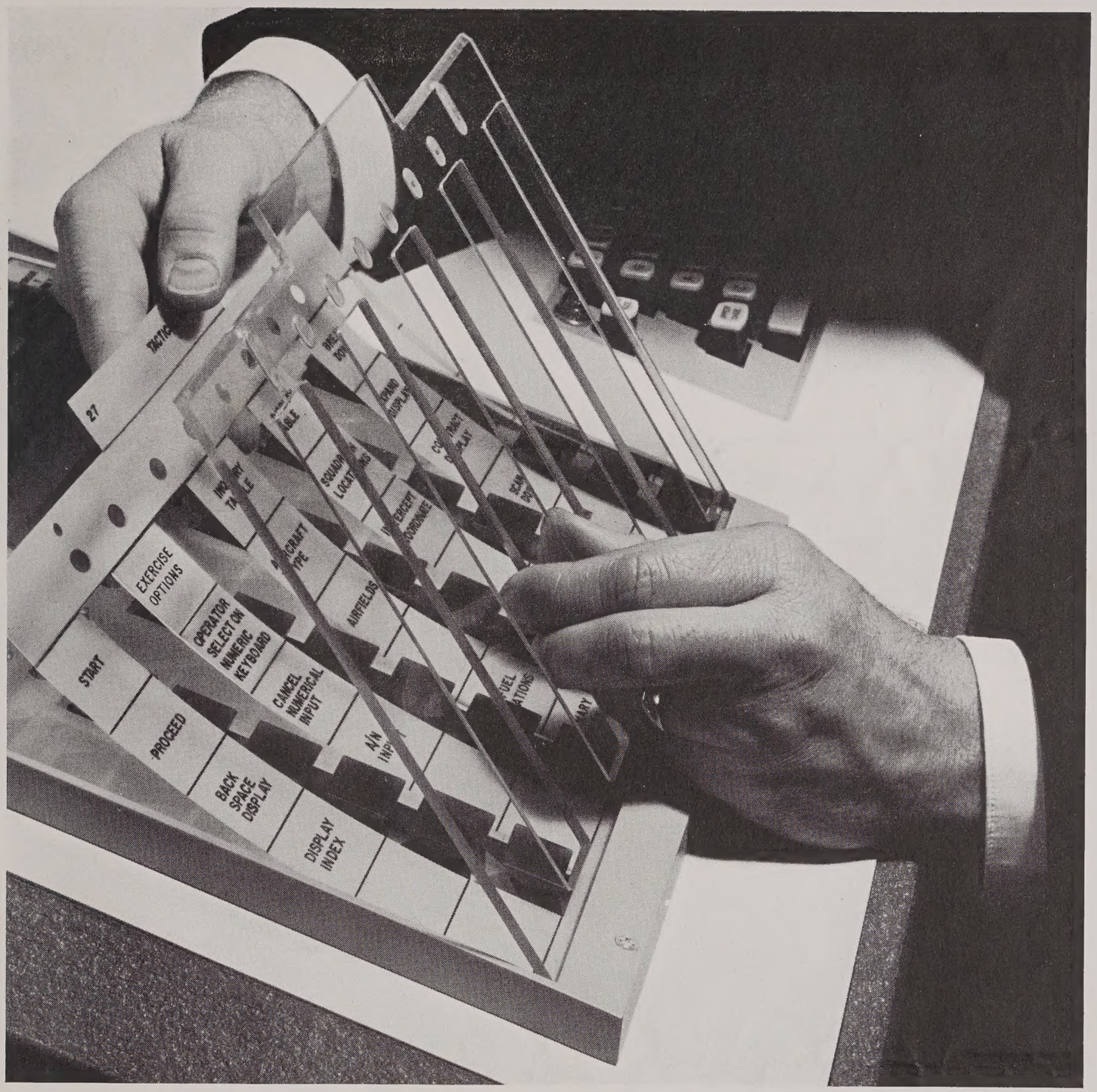

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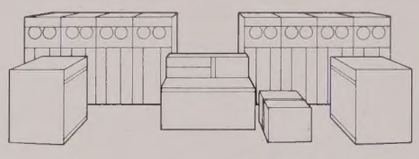
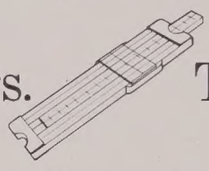
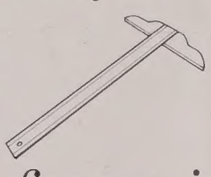
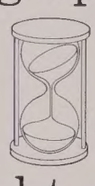
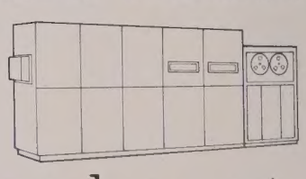
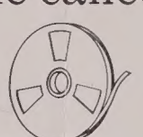
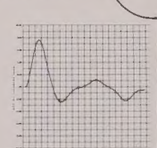
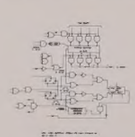
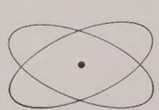
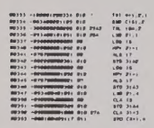
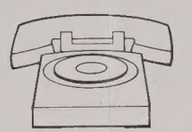
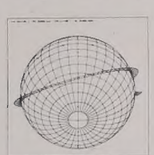
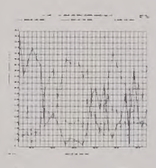
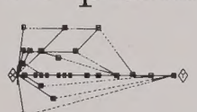
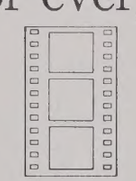
The machine that helped a computer work for everybody

Once upon a time, a company bought a large-scale digital computer.  It was very useful but - alas! - expensive. It was hoped all departments would benefit, but because the computer-printer generated only row after row of numbers and symbols, it was used only by the engineers.  They took their armloads of papers to the drafting department  where an army of draftsmen and clerks converted the figures into charts, graphs and drawings. This was expensive and time consuming,  and some charts were needed immediately. Then a bright engineer learned about a new kind of machine called the S-C 4020  that takes the information  from a computer and converts it into curves, graphs  and pictures.  And this machine keeps up with big computers because it prints with electron beams  instead of a hammer or stylus. Of course,

the S-C 4020 prints words and numbers  too, so they got one. The engineers talked  about their versatile new machine, and soon other company departments were using it to solve their problems by transforming numbers into picture form  that everybody could understand and use. The comptroller used the S-C 4020 to draw graphs and charts  for his financial reports. The marketing manager produced sales maps. The production man used it for tool path drawings. The planning people used it to update critical path diagrams.  And the S-C 4020 saved space for everybody by storing all kinds of information on microfilm.  (Naturally it prints paper copies, too.) If your computer has a usage barrier, learn how the S-C 4020 can help it to talk in everybody's language. Write to *General Dynamics|Electronics,* Department D-37, P. O. Box 127, San Diego 12, California.

Each of the sample illustrations above were actually produced in less than one-half second on the S-C 4020.

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A letter from the PUBLISHER

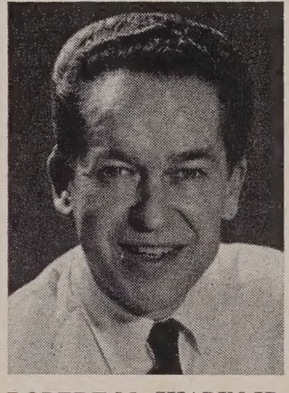
Bernhard M. Auer

THE handsome new building (*right*) under a brooding Paris sky is the $5,000,000, nine-story TIME & LIFE building on the Avenue Matignon, just off the Champs Elysées. When the building opens this fall, TIME Inc. will occupy the top three floors; the rest of the office space has already been rented, mostly to subsidiaries of U.S. companies.

The lowering sky may come from the fact that the unretouched picture shown here was transmitted last week with the speed of light from Paris to the TIME & LIFE Building in New York City, bouncing off the communications satellite Telstar as it hurried 3,000 miles overhead.

THE sight of husky New York cops dressed up as women to decoy nighttime muggers gave Manhattan newspaper feature writers their biggest outing in transvestite humor since *Charley's Aunt*. But the program, said New York's finest, has paid off with "remarkable success" (*see* THE NATION). Police Commissioner Michael Murphy was the first to give credit where credit is due: he was merely expanding on an idea tried out in St. Louis that the commissioner read about in TIME just last week.

MARTHA HOLMES



ROBERT M. CHAPIN JR.

TIME & LIFE, PARIS

THIS week it is the Berlin wall. Last week it was the flight of Russia's space twins. Fortnight ago, it was Senator Byrd's family tree. Week after week, Robert M. Chapin Jr. seeks vivid new pictorial ways to illustrate the news. He has been doing it for 25 years for TIME. Beginning as a one-man operation, Chapin now has a staff of six, including Artists Vincent Puglisi and Jere Donovan, to turn out an average of six to eight maps, charts, drawings and diagrams weekly. A few years back, Walter W. Ristow of the Library of Congress declared that "Chapin maps have established a pattern and style for modern newsmagazine cartography," and referred to Chapin as one of the "major pillars" of the craft.

A trained architect (University of Pennsylvania, '33), Chapin decided in the Depression that he would rather be an employed cartographer than a starving architect. He has since been able to combine a little of both interests: he built his own modern hilltop home in Sharon, Conn., and is currently chairman of the building committee for a $1,500,000 improvement of the Sharon Hospital.

On the job, Chapin seeks by graphic inventiveness to "accent the point of a story, not just to produce a reference map." He avidly enjoys charting space exploration, and looks forward to "real detailed maps of the moon to work with."

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91. Fort Crailo (State-owned historic site)-Rensselaer. Dutch manor house built about 1704 by Hendrick Van Rensselaer. Period furnishings. Words to Yankee Doodle said to have been written here by Dr. Richard Shuckburgh. Mon-Sat 9-5; Sun 1-5, free.

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